

1 **THE EMBODIMENTS OF THE INVENTION FOR WHICH AN**
2 **EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS**
3 **FOLLOWS:**
4

5 1. A method for automatic adjustment of the color of a digital original
6 image for forming a digital adjusted image, the original image being a whole of a
7 supplied digital image or a portion thereof and being formed of a plurality of color
8 dots, each dot having at least three independent values representing the strength of
9 the three primary colors R, G, and B, each strength value lying between a minimum
10 and a maximum of a dynamic range, comprising:

11 determining an original dot maximum of the R, G, or B strength values
12 in RGB color space for each color dot within the original image for establishing an
13 original histogram of original dot maximums for the plurality of color dots within the
14 original image;

15 establishing an original average strength of the original histogram;

16 amplifying each of the original dot maximums by selecting a correcting
17 scaling factor from a continuous scaling function and applying the correcting scaling
18 factor for each original dot maximum which scales the original dot maximum to a
19 scaled dot maximum which is less than or equal to the maximum of the dynamic
20 range;

21 establishing a corrected average strength of the original dot
22 maximums from a corrected histogram of the scaled dot maximums;

23 comparing the original average strength to a target average strength;

1 determining an interpolation constant between an identity scaling
2 factor of 1 and the correcting scaling factor for each original dot maximum by
3 interpolation using the target average strength, the corrected average strength and
4 the original average strength for each; and

5 creating an adjusted image without color distortion by applying the
6 interpolation constant to modify the correcting scaling factor for each original dot
7 maximum and establishing a target scaling factor which is applied to each color
8 dot's R, G and B strength values so that a histogram of the adjusted image has the
9 target average strength and that the ratios of the strength values between R, G and
10 B for the color dot remain the same after scaling as they were before scaling.

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12 2. The method of claim 1 wherein the scaling function is non-linear
13 and continuous.

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1 3. The method of claim 1 wherein the supplied image is corrected
2 prior to adjustment of the color of the digital original image for forming the digital
3 adjusted image further comprising:

4 establishing a supplied histogram of R, G, or B strength values for
5 each color dot within the supplied image;

6 determining a offset strength value between the minimum of the
7 dynamic range of the system and a minimum threshold strength value of the
8 supplied histogram;

9 subtracting the offset strength value from each R, G, and B value for
10 forming the original image for automatic correction thereof.

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12 4. The method of claim 3 wherein minimum threshold strength value
13 of the supplied dot minimums is the minimum strength for a majority of the color
14 dots.

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16 5. The method of claim 4 wherein the majority of the color dots is
17 between 99 % and 100% of the color dots.

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19 6. The method of claim 5 wherein the majority of the color dots is
20 between 99.5 and 99.9 % of the color dots.

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22 7. The method of claim 1 where the target average strength is
23 selected empirically.

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2 8. The method of claim 7 where the target average strength is
3 between 50 and 65 % of the dynamic range.

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5 9. The method of claim 8 where the target average strength is about
6 58% of the dynamic range.

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8 10. The method of claim 1 where the continuous scaling function is a
9 polynomial function.

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11 11. The method of claim 1 where the continuous scaling function has a
12 form $f(x) = a + 10^{bx}$ and $DR_{min} \leq x < x_0$, where DR_{min} is the minimum of the dynamic
13 range and $f(0) = 0$ and x_0 is an anchor strength value intermediate the minimum and
14 the maximum of the dynamic range and $f(x_0) = x_0$.

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16 12. The method of claim 11 where the continuous scaling function has
17 a form $f(x) = a + \log_{10}(bx)$ and $x_0 \leq x < DR_{max}$, between the anchor strength value x_0
18 DR_{max} is the maximum of the dynamic range where $f(x_0) = x_0$ and $f(DR_{max}) = DR_{max}$.

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1 13.The method of claim 1 wherein the interpolation constant is
2 determined as follows:

$$\begin{array}{l} 3 \qquad \qquad \% \text{CORR} = \frac{(\text{STR}_{\text{TARGET}} - \text{STR}_{\text{ORIGINAL}})}{(\text{STR}_{\text{CORRECTED}} - \text{STR}_{\text{ORIGINAL}})} \times 100 \\ 4 \end{array}$$

5 where

6 $\text{STR}_{\text{TARGET}}$ is the pre-determined target average strength value,

7 $\text{STR}_{\text{ORIGINAL}}$ is the original average strength value,

8 $\text{STR}_{\text{CORRECTED}}$ is the corrected average strength value, and

9 % CORR is the interpolation constant expressed as a percentage that
10 the target scaling factor is between the corrected scaling factor and the identity
11 scaling factor.
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13 14.The method of claim 13 wherein the target scaling factor for each
14 original dot maximum is determined as follows:

$$\begin{array}{l} 15 \qquad \qquad \text{TSF} = \frac{(\% \text{CORR} * (\text{DotMax}_{\text{CORRECTED}} - \text{DotMax}_{\text{ORIGINAL}}) + \text{DotMax}_{\text{ORIGINAL}})}{(100 * \text{DotMax}_{\text{ORIGINAL}})} \\ 16 \end{array}$$

17 where:

18 $\text{DotMax}_{\text{CORRECTED}}$ represents the corrected dot maximum;

19 $\text{DotMax}_{\text{ORIGINAL}}$ represents the original dot maximum;
20

21 15.The method of claim 13 wherein

22 if % CORR > 80%, then % CORR = 80%;

23 if 0% < % CORR < 80%, then % CORR = % CORR; and

24 if % CORR < 0%, then % CORR = 0%.

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1 16. A method for automatic adjustment of the color of a digital image
2 or a portion thereof, the image being formed of a plurality of color dots, each dot
3 having at least three independent values representing the strength of the three
4 primary colors R, G, and B, each strength value lying between a minimum and a
5 maximum of a dynamic range, comprising:

6 establishing an original histogram of dot maximums for the plurality of
7 color dots within the original image and an original average strength thereof;

8 amplifying each dot maximum with a scaling factor selected from a
9 continuous scaling function to obtain a scaled dot maximum which is less than or
10 equal to the maximum of the dynamic range;

11 establishing a corrected histogram of scaled dot maximums and a
12 corrected average strength thereof;

13 interpolating a target scaling factor from a target average strength, the
14 corrected average strength and the original average strength for each dot
15 maximum; and

16 creating the adjusted image without color distortion by applying the
17 target scaling factors to each color dot's R, G and B strength values so that a
18 histogram of the adjusted image has the target average strength and that the ratios
19 of the strength values between R, G and B for the color dot remain the same after
20 scaling as they were before scaling.

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1 17. The method of claim 16 wherein the image is corrected prior to
2 adjustment of the color further comprising:
3 establishing a supplied histogram of R, G, or B strength values for
4 each color dot within the supplied image;
5 determining a offset strength value between the minimum of the
6 dynamic range of the system and a minimum threshold strength value of the
7 supplied histogram; and
8 subtracting the offset strength value from each R, G, and B value for
9 forming the original image for automatic correction thereof.

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